NOTES ON TWO SAND-DWELLING CUMACEA (*GEPHYROCUMA* AND *PICROCUMA*)

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Fig. 1–9.

INTRODUCTION.

During the preparation of a previous paper (Hale, 1936, pp. 393–438) the writer collected sample catches of the burrowing Crustacea (Amphipods, Cumacea, etc.) occurring at the edge of the sea in Aldinga Bay, St. Vincent Gulf, South Australia. These were placed in glass jars of seawater for observation and the following general notes concerning them were made.

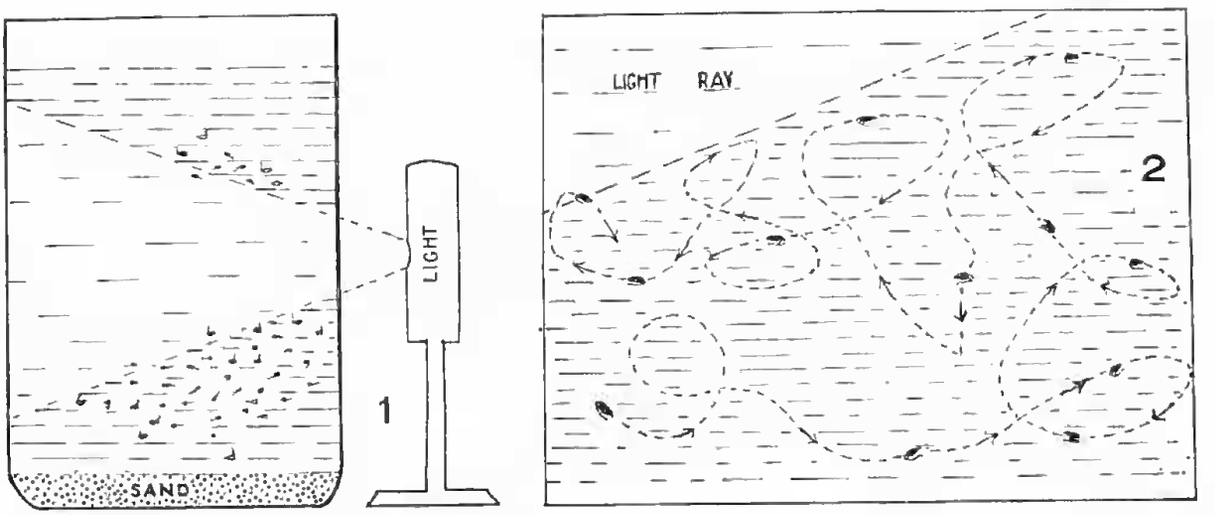


Fig. 1. Response of *Picrocuma* and *Gephyrocuma* to stimulus of light.
Fig. 2. Track of *Picrocuma* approaching light ray with pleon folded under thorax.

A layer of about three inches of sand was placed in some of the vessels. In these the fossorial Crustacea were rarely seen in bright daylight; under the same conditions, with jars containing water only, activity was very restricted. Movement became accelerated towards dusk whether sand was present or not but, later in the evening, in complete darkness, activity continued where sand was absent, but few or no swimmers were apparent in the jars containing sand.

To facilitate observations at night and to test response to the stimulus of light, a cone of light of low candle-power intensity was thrown through an aquarium otherwise in darkness (fig. 1).

Two species of Cumacea, *Gephyrocuma* and *Picrocuma*, readily separable with the naked eye from the other material and from each other, were placed in this illuminated tank.

These Cumacea were definitely attracted by the light, but in general did not

congregate in the brightest part of the ray but, for a considerable period at least, just outside it (fig. 1; see also Foxon, 1936, p. 379). Progress towards a brighter light under one observation was slower.

In complete darkness both Cumacea became pale, almost white.

A dim submarine light has been used successfully for the collecting of large numbers of Cumacea and other small Crustacea (Sheard, 1941, p. 12); it seems that the most profitable period for its employment is just after nightfall.

PICROCUMA HALE.

Picrocuma poecilota Hale, 1936, p. 415, fig. 7–8.

Specimens are now available from several localities in St. Vincent Gulf, South Australia. As the male is unknown the species was referred provisionally to the Bodotriidae.

SWIMMING HABITS.

As noted by Foxon (1936, p. 378): "Cumaceans do not respond to light in the marked manner of Decapod larvae, and they employ various methods of locomotion". *Picrocuma* readily follows the light of a torch to one side or other of an aquarium, and also to the surface of the water; in daylight it does not ascend more than two or three inches above the sand layer unless it be at dusk or indoors in a dim light, under which circumstances it may be found near the surface.

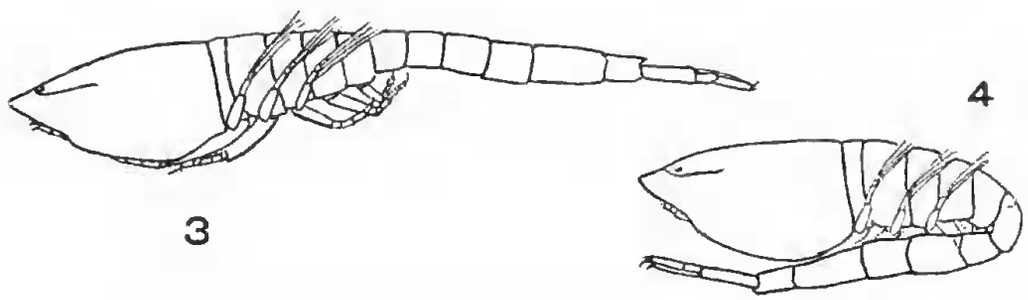


Fig. 3, and 4. Swimming attitudes of *Picrocuma poecilota* (× 35).

The animal may progress with a relatively smooth motion, propelling itself with rapid vibratory movements of the exopods of the anterior thoracic appendages; the yellowish pleon may be extended (fig. 3) or may be carried adpressed to the body (fig. 4) and only occasionally extended. Even when the pleon is extended during swimming it is folded against the body directly effort ceases and the animal commences to sink. Swimming with the pleon against the body the crustacean progresses in a manner reminiscent of an Ostracod and tends to pursue a rather rambling course in its approach to a light ray. The approximate track of an individual is shown in fig. 2.

At times swimming is assisted by rapid up and down movements of the pleon, similar to those of the pupa of a *Culex*; these motions, however, seem to play a subsidiary part in defined progress.

BURROWING, ETC.

As mentioned above, *Picrocuma*, when swimming ceases, folds the pleon under the body; it then sinks at the rate of about one inch per second; in this position it

awkwardly reaches the bottom and may rest for a time on its side. Righting itself it is able to move rapidly *through* the top layer of sand, "breasting" along with the thorax obliquely upright and the pleon directed obliquely upwards and backwards (fig. 5) or sometimes curved in the position shown in fig. 6.

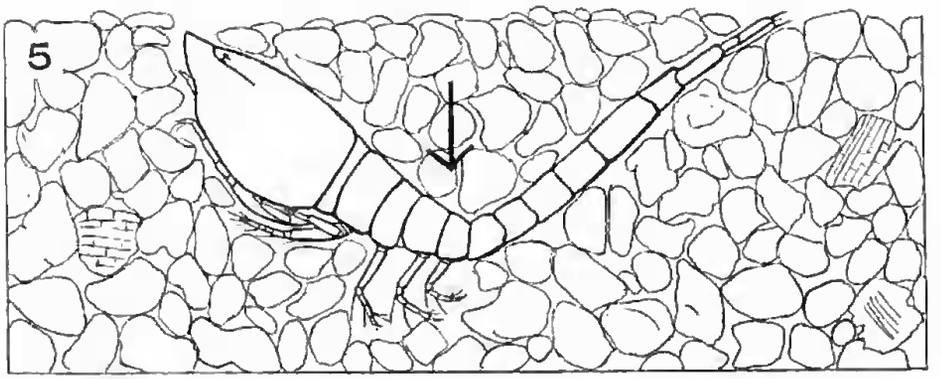
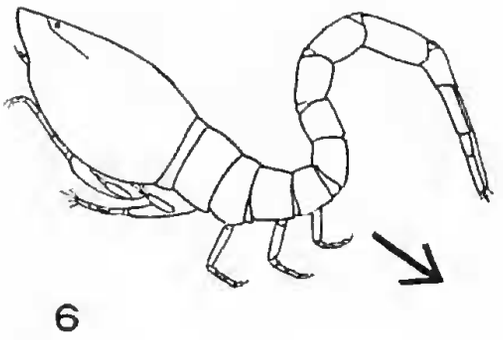


Fig. 5. Attitude of *Picrocuma poecilota* when buried in the sand; arrow shows direction of entry (× 35).

Observation of burrowing, etc., was made in a watch glass. As a rule the animal burrows straight down in the attitude it assumes when travelling in the upper layer of sand. A forward motion may be suddenly arrested and a downward movement commenced; the three posterior pairs of thoracic appendages are mainly responsible for both operations although the first pair of peraeopods are sometimes used to push aside sand grains in the last stages.



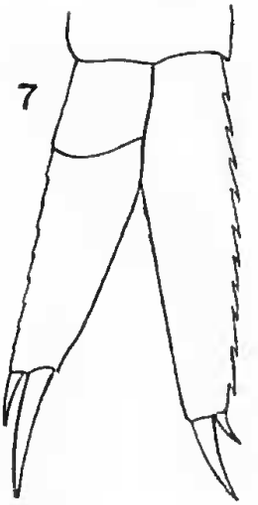


Fig. 6. Occasional burrowing attiude of *Picrocuma poecilota*; arrow shows direction of entry (× 35).

Fig. 7. Rami of uropoda of *Picrocuma poecilota* (× 250).

A few individuals were seen to burrow in the attitude shown in fig. 6; in this position they entered the sand "backwards", at an oblique angle.

Picrocuma is often completely concealed below the sand or has only the tips of the uropods visible (fig. 5); when so hidden a tiny depression marks its presence. It also travels just *beneath* the surface of the sand, its rapid progress being easily followed by disturbed grains.

The addition of fresh seawater accelerates the respiratory movements, the anterior exhalent tubes "flickering" with great rapidity.

In feeding, sand-grains are grasped with the first pair of legs and rotated rapidly in front of the mouth. It may be noted here that the sand at Aldinga Bay is rather coarse, individual grains ranging from 0·15 mm. up to 0·35 mm. in greatest diameter; the adult female of *Picrocuma* is 1·9 mm. in total length. The camera lucida drawing in fig. 5 shows the relative size of the grains.

USE OF UROPODS.

In one observation only the pleon (held as in fig. 6) was thrust into the sand in the initial burrowing motions; the appressed uropods, forming an awl-like point, were first pressed down between the grains.

The uropods, with their terminal spines, are used to clean the mouth parts, the first antennae, to comb the hairs of the peraeopods and even to brush over the sides of the carapace; the finely serrated inner margin of the endopod may be of use here (fig. 7).

SUMMARY.

The thoracic exopods are the principal swimming organs and the pleon apparently plays no major part in either burrowing or swimming; these notes, however, concern sub-adult specimens and the adult male is unknown. The first peraeopods are used mainly for food-getting although they sometimes assist burrowing by pushing to one side the larger grains of sand.

The use of the uropods as toilet combs was observed.

GEPHYROCUMA HALE.

Gephyrocuma pala Hale, 1936, p. 412, fig. 5–6.

Since its description *ut supra* adult males of this curious species have been taken in New South Wales at depths down to fifty metres, on sandy bottoms.

SWIMMING HABITS.

The species is larger and bulkier than *Picrocuma* and in sharp distinction to the last-named the transparent pleon is held always upwards and straight or slightly curved, more or less at a right angle to the thorax; the position is well shown in the original figures of the species (Hale, 1936, p. 413, fig. 5, a and c).

Both males and ovigerous females are rather active swimmers; the movements can best be described as "jerky", particularly when travelling upwards. In general the behaviour is much as in *Picrocuma* and the response to light is similar.

BURROWING, ETC.

When swimming movements cease the animal sinks, with pleon still erect, at the rate of about one inch each second. It lands haphazard on the bottom, often on the side.

Gephyrocuma can skip rapidly over the surface of the sandy bottom with a series of flea-like hops (fig. 8).

In burrowing the creature enters the sand with the thorax in an upright, or almost upright position, sometimes slightly laterally oblique, sometimes backwardly oblique; the pleon remains directed at approximately a right angle to the

thorax. The greater part of the animal disappears in a flash. The rakes of spines with which the transparent posterior peraeopods are armed (Hale, 1936, p. 414, fig. 6, f, g and h) rapidly thrust aside the grains of sand to clear a space for the stout body. Movement of the pleon suggests that, with an upward thrust below the sand, it assists in pulling the thorax deeper, but it was not possible to substantiate this definitely.

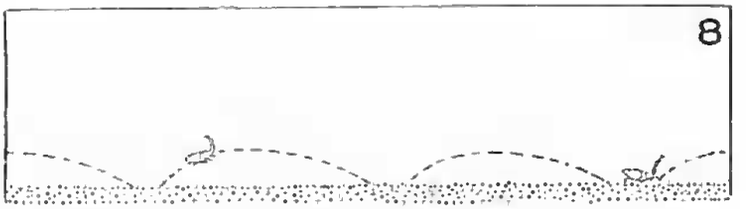


Fig. 8. *Gephyrocuma pala*, underwater "skipping" progress over sand surface.

The attitude when buried is illustrated in fig. 9. A dorsal view shows the frons well exposed (not concealed or almost so as in *Picrocuma*) ; a slight shock—such as a tap on the containing vessel—causes the creature to withdraw more deeply into the sand but the frons still remains visible. The chalky white distal portions of the carapace and first peraeopods simulate the shell fragments in the sand and grit.

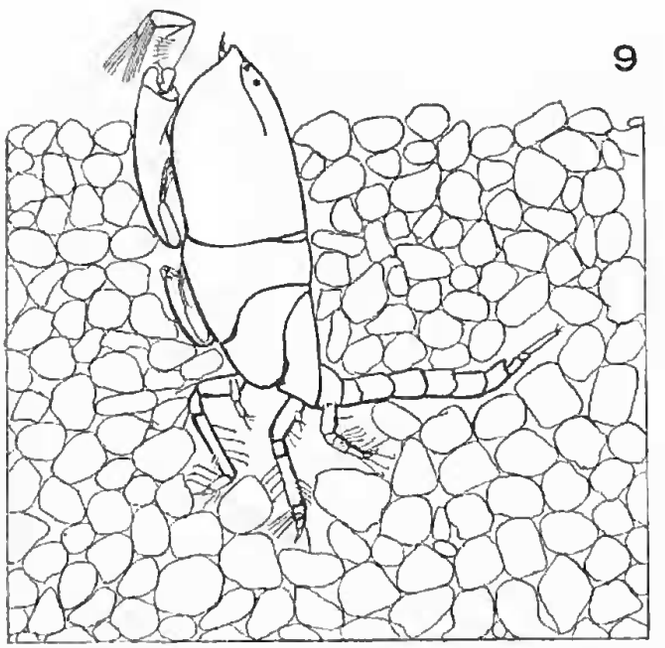


Fig. 9. Attitude of *Gephyrocuma pala* when buried in sand (× 32).

Viewed from above, apparent movements are jerking of the first antennae and grasping motions of the five transparent terminal segments of the first peraeopods. The exhalent aperture is single, large and oval in shape, and the current is strong, moving flocculent material on the sand surface.

A buried example often pops out from the sand and skips to a fresh spot and immediately disappears below save for the exposed frons.

The adult *Gephyrocuma* is about 2·5 mm. in length. Its relation in size to the grains of sand into which it burrows is illustrated in fig. 9.

SUMMARY.

The position in which the relatively short pleon is consistently carried is characteristic of *Gephyrocuma*. The species spends little time *wholly* concealed in the sand.

Details of the burrowing procedure are difficult to observe because of the speed with which the operation is carried out. It seems certain, however, that the spines of the three pairs of stout posterior peraeopods constitute an important apparatus for fast burrowing, as a considerable displacement is necessary to accommodate the bulky thorax.

The mechanism of the rapid "skipping" progress over the sand surface could not be determined.

Feeding was not detected although, as mentioned, grasping or "casting" movements were made with the first peraeopods. The specialized structure of these limbs, with their widened terminal segments, forming efficient supports for the unusually large brushes of plumose setae (see Hale, 1936, p. 414, fig. 6d) presents interesting possibilities.

The first legs of *Leptocuma australiae* Zimmer (1921, fig. 1 and 5) are remarkably similar in general form to those of *Gephyrocuma*.

REFERENCES CITED.

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